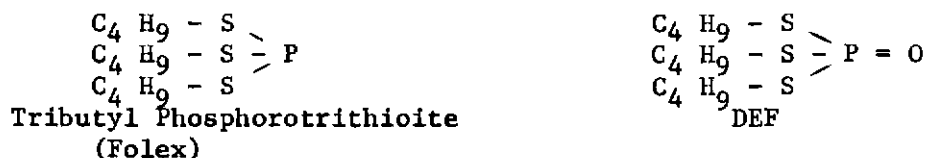


DECLINE OF DEF AND FOLEX RESIDUE ON COTTON FIELDS
KERN AND TULARE COUNTIES -- SEPTEMBER-OCTOBER 1975*

AGRICULTURAL CHEMICALS AND FEED
CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE
1220 N Street
Sacramento, California 95814

DEF (Chemagro Division, Mobay Chemical) and Folex (Mobil Chemical Co., Industrial Chemicals Division) are organophosphorus chemicals widely used in cotton culture as defoliant. The compounds have similar structure and in the environment Folex is rapidly oxidized to DEF:



Both products are marketed in emulsifiable liquid concentrates containing six pounds of active ingredient per gallon. In 1975, 426,754 pounds of DEF and 163,468 pounds of Folex were used to treat 241,171 and 99,875 acres of California cotton respectively.

Experimental Design

In order to measure the dissipation of DEF and Folex in cotton fields, foliage of five treated fields was sampled at intervals following application. The five applications studied are designated Fields 1 through 5 for convenience:

	<u>Date of App.</u>	<u>Tank mixture/acre</u>	<u>DEF or Folex/acre</u>	<u>Spray Volume and Method</u>
Field 1	Sept 23, 1975	1-1/2 pt. DEF-6, 1-1/2 pt. Bolls'-eye, 0.24 pt. Nutrawet	1.13 lbs.	12 gal/acre (air)
Field 2	Sept 24, 1975	2 pt. Folex, 1-1/2 pt. Bolls'-eye	1.50 lbs.	10 gal/acre (air)
Field 3	Sept 30, 1975	1-1/2 pt. DEF-6, 1/2 pt. Paraquat, 0.24 pt. Kerntox B-99 spreader	1.13 lbs.	10 gal/acre (air)
Field 4	Oct 1, 1975	2 pt. Folex, 1/2 pt. Paraquat, 0.12 pt. K-90 spreader	1.50 lbs	10 gal/acre (air)

* Staff Work on Report by Gary Sprock, Agricultural Inspector

<u>Time Post Application</u>	<u>Dislodgeable Residue</u>		<u>Penetrated Residue</u>		<u>Total Residue</u>	
<u>Field 4 - 2 pt. Folex/10 gal/acre, applied 0800 hrs. 10/1/75.</u>						
	<u>Folex</u>	<u>DEF</u>	<u>Folex</u>	<u>DEF</u>	<u>Folex</u>	<u>DEF</u>
1 Hour	34.9 23.9	102 74.6	9.60 9.24	116	4.2	147
7 Hours	ND ND	46.0 49.4	ND ND	122 148	ND	168
25 Hours	ND ND	23.2 24.6	ND ND	84 122	ND	175
2 Days*	ND ND	3.1 5.9	ND ND	41.5 65.9	ND	64.2

Field 5 - 3 pt. DEF-6/30 gal/acre, applied 1230 hrs. 10/8/75.

	<u>DEF</u>	<u>DEF</u>	<u>DEF</u>
(Preapplication)	ND ND	ND ND	1.0
1 Hour	186 130	262 168	286
6 Hours	88.6 86.0	164 147	283
22 Hours	105 146	184 162	261
28 Hours	64.5 57.4	172 167	212
45 Hours	50.5 54.6	187 171	178
51 Hours	38.1 33.1	167 155	185

ND - Below detectable level.

* - Samples stored 15 days @ 8°C prior to extraction.

TABLE 2

WEATHER OBSERVATIONS MADE AT THE STUDY LOCALES

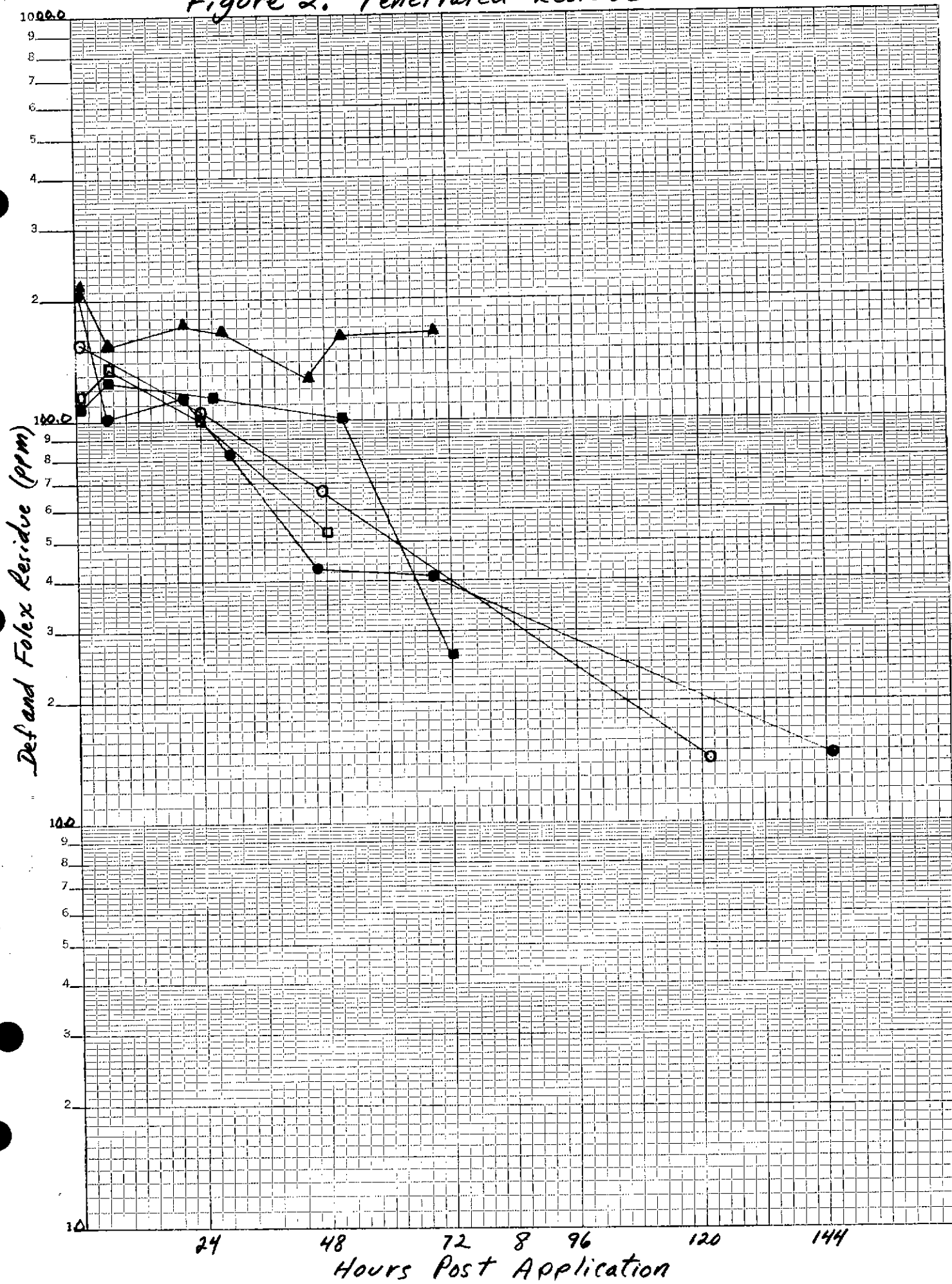
DAILY WEATHER OBSERVATIONS MADE AT BAKERSFIELD
BY THE NATIONAL WEATHER SERVICE

<u>Date</u>	<u>Temperature (°F)</u>		<u>Precipitation (Inches)</u>
	<u>24 hours ending at midnight</u>		<u>24 hour amounts ending at midnight</u>
	<u>Max</u>	<u>Min</u>	
9/23	97	70	
9/24	100	70	
9/25	103	69	
9/26	100	69	
9/27	97	71	
9/28	91	66	
9/29	91	66	
9/30	94	67	
10/1	95	68	
10/2	93	67	
10/3	93	69	
			<u>0</u>

DAILY WEATHER OBSERVATIONS MADE AT VISALIA
BY THE VISALIA FIRE DEPARTMENT

<u>Date</u>	<u>Temperature (°F)</u>		<u>Precipitation (Inches)</u>
	<u>24 hours ending at 8:00 AM</u>		<u>24 hour amounts ending at 8:00 AM</u>
	<u>Max</u>	<u>Min</u>	
10/8	67	45	
10/9	75	50	
10/10	73	56	
10/11	71	55	
			<u>0.29</u>
			0.29

Figure 2. Penetrated Residue



	<u>Date of App.</u>	<u>Tank mixture/acre</u>	<u>DEF or Folex/acre</u>	<u>Spray Volume and Method</u>
Field 5	Oct 8, 1975	3 pts. DEF-6, 1/2 pt. Accelerate (endothall), 0.24 pt. Western Farm Service spreader	2.25 lbs.	30 gal/acre (ground spray)

Fields 1 through 4 were located near Bakersfield, Kern County; Field 5 near Visalia, Tulare County.

The specific analyses for DEF and Folex on the foliage samples were completed in a California Department of Food and Agriculture mobile laboratory stationed at either the Kern County or the Tulare County Agricultural Commissioner's office. Triplicate samples, each consisting of 100 leaf discs, 18 mm in diameter, were collected at each sampling interval. Two samples were analyzed for dislodgeable and penetrated residue fractions and the third was analyzed for total residue. Dislodgeable residue is defined as that portion removed from the sample by agitation in an aqueous solution containing a surfactant. Penetrated residue is defined as the amount remaining in the leaf discs following the aqueous wash. The procedure used in the extraction of dislodgeable, penetrated and total residues from leaf discs is detailed in an attachment. The analyses were carried out by gas chromatography.

Air sampling equipment was employed by staff members of the University of California at Davis, Food Protection and Toxicology Center, to concurrently monitor the levels of DEF in the air near Field 5.

Results

Levels of dislodgeable, penetrated and total residues observed are given in Table 1. Daily temperature and precipitation observations made at the study locales are given in Table 2. Semi-logarithmic plots of average values obtained for dislodgeable and penetrated residues are given in Figures 1 and 2. Dislodgeable residues declined to ten percent of initial deposition levels within three days. Penetrated residues would appear to be reduced by 50 percent after three days. Results of air sampling conducted near Field 5 will be issued when they are received from the UCD personnel.

TABLE 1

DEF AND FOLEX RESIDUE ON COTTON LEAVES (ppm)

<u>Time Post Application</u>	<u>Dislodgeable Residue</u>	<u>Penetrated Residue</u>	<u>Total Residue</u>
<u>Field 1 - 1-1/2 pt. DEF-6/12 gal/acre, applied 1100 hrs. 9/23/75.</u>			
	<u>DEF</u>	<u>DEF</u>	<u>DEF</u>
1 Hour	81.2	219	
	60.2	182	
			161
6 Hours	57.5	105	
	70.1	95.5	
			145
21 Hours	28.0	132	
	19.5	91.1	
			100
29 Hours	12.3	85.4	
	8.74	60.9	
			79.6
2 Days	4.63	49.6	
	4.63	37.8	
			48.5
3 Days	4.14	42.7	
	4.83	38.6	
			47.3
6 Days	1.96	16.2	
	1.58	13.4	
			16.6
9 Days	1.00	10.4	
	0.24	10.8	
			14.9

<u>Time Post Application</u>	<u>Dislodgeable Residue</u>	<u>Penetrated Residue</u>	<u>Total Residue</u>
----------------------------------	---------------------------------	-------------------------------	--------------------------

Field 2 - 2 pt. Folex/10 gal/acre, applied 1130 hrs. 9/24/75.

	<u>Folex</u>	<u>DEF</u>	<u>Folex</u>	<u>DEF</u>	<u>Folex</u>	<u>DEF</u>
1 Hour	ND	62.0	ND	119		
	ND	66.5	ND	188		
					ND	173
24 Hours	ND	57.1	ND	121		
	ND	43.7	ND	91.6		
					ND	142
2 Days	ND	19.4	ND	68.8		
	ND	16.0	ND	66.5		
					ND	58.2
5 Days	ND	2.03	ND	13.6		
	ND	2.02	ND	14.3		
					ND	11.0

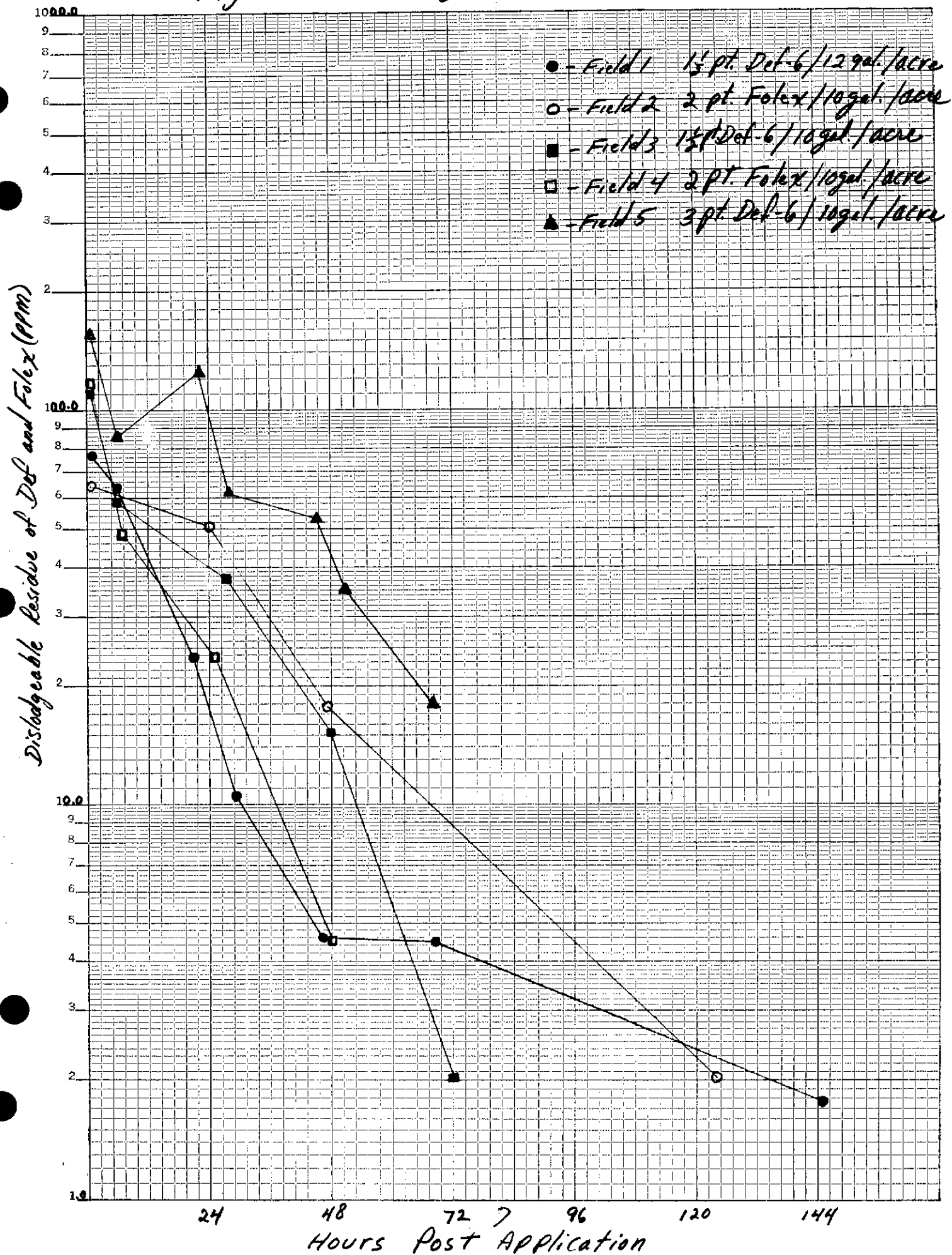
Field 3 - 1-1/2 pt. DEF-6/10 gal/acre, applied 1000 hrs. 9/30/75.

	<u>DEF</u>	<u>DEF</u>	<u>DEF</u>
1 Hour	105	116	
	115	102	
			214
6 Hours	64.9	118	
	54.9	135	
			142
27 Hours	36.0	109	
	40.0	121	
			126
2 Days	12.5	86.0	
	18.3	115	
			85.5
3 Days*	1.3	22.7	
	2.8	29.5	
			23.8

Penetrated Residues

After the last water wash is drained for the dislodgeable residue, the leaf discs are transferred to a blending cup and treated the same as a total residue sample. The empty sample container is weighed and the net sample weight recorded.

Figure 1. Dislodgeable Residue



A PROCEDURE FOR THE EXTRACTION OF
DISLODGEABLE, PENETRATED, AND TOTAL RESIDUES
FROM LEAF DISC SAMPLES

The procedure used for the extraction of dislodgeable, penetrated, and total residues from leaf discs was adapted from that described by Gunther, et al. in The Bulletin of Environmental Contamination and Toxicology, 9 243-249 (1973).

Total Residues

1. The leaf discs are transferred to a blending cup. The empty sample container is again weighed and the net weight of the leaf discs recorded.
2. Approximately 50 grams of sodium sulfate and exactly 100 mls of a suitable organic solvent are added.
3. The sample is blended at high speed for 3 minutes, with the blender cup being kept cool by immersion in water. The blender cup is removed and the sample allowed to settle.
4. A sample of the supernatant is decanted into a teflon capped bottle and stored in a freezer prior to cleanup (when required) and analysis.

Dislodgeable Residues

1. Fifty mls of water and approximately 4 drops of 1:50 Sur-Ten Solution (a surfactant) is added to the original sample containers. The containers are capped and placed in a multipurpose rotator and rotated end over end at 30 cycles/minute for 60 minutes. The aqueous solution is decanted through a glass wool plug into a 500 ml separatory funnel.
2. The leaf discs are rotated a second time, using 50 mls of water and 4 drops Sur-Ten Solution, for 30 minutes. This is added to the first wash.
3. The sample is then hand shaken for 10 seconds with 30 mls of water. The container is drained into the separatory funnel with the first two washings.
4. The aqueous solution is extracted three times with 50 ml portions of organic solvent. The solvent is filtered through sodium sulfate into a glass stoppered mixing cylinder and the volume is recorded. The solvent is mixed in the cylinder and a sample decanted into a teflon capped bottle and stored in the freezer prior to cleanup (when required) and analysis.